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# ENTERPRISE ARCHITECTURE DEVELOPMENT AND IMPLEMENTATION IN PUBLIC SECTOR: THE MALAYSIAN PERSPECTIVE

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**ABSTRACT**

Enterprise Architecture (EA) is gaining the attention from the public sector as a solution to improve the function of e-Government. However, public sector agencies are having difficulties with its development and implementation due to inflexibility and complexity of the agencies' business function and information technology structures. The objective of this paper is to identify the challenges faced by the Malaysian public sector agencies that are in development and implementation phase of EA. In order to get the holistic perspective of EA development and implementation scenario in each organisation, a Balanced Scorecard (BSC) approach is applied. A multiple case study research approach is utilized to achieve this study objective. Data were collected through interviews with the agencies EA team, general observation during the EA workshops as well as review of EA related documents. The result shows there are twenty challenges identified which is consistent with other challenges stated in literature except for talent management issue. Thus, this provides a new insight on how the public sector should implement their EA as compared to any other organisation.

**Keywords:** *Enterprise Architecture, public sector, Balanced Scorecard, EA development, EA implementation*

## 1. INTRODUCTION

As part of the public sector modernization plan, governments seek to offer their citizens a seamless service delivery. Due to the poor performance of Electronic Government (e-Gov) approach, Enterprise Architecture (EA) initiative is introduced to fulfil the initial e-Gov purpose. EA is a hierarchical approach for aligning business and Information Technology (IT) by integrating the information systems, processes, organizational units and people in an organisation. The aim is to further enhance the various IT system in the public service to provide a better service to the citizens and business [1, 2]. EA also will translate the organizational vision and mission into operational reality and leverage on current technology to improve the public sector service delivery system [3, 4].

EA is a practice that analyses areas of common activity within or between organisation, where information and other resources are exchanged to guide future states from an integrated viewpoint of strategy, business and technology [5]. It provides a blueprint for defining the structure and operation of organisation throughout these four layers, business, data, application and technology [6]. EA is designed as a tool for strategic management that helps in bringing together business process and IT. It provides clear direction in managing information, applications and technology in driving the development for more effective organizational management. Through EA, the process of sharing information between organizations will be more efficient. In brief, EA is a hierarchical way of describing how the information systems, business processes and people in an organisation function as a whole [7-9].

The increasing attention for EA in government is also due to the transformational government criteria stated in e-Gov policy reports by United Nations E-Government Survey 2014 [10] and Waseda University World E-Government Ranking [11]. The implementation of EA is important as it contributed to the score that indicates the level of advancement of e-Gov as outlined by these two bodies. Therefore, in 2014 Malaysian public sector has embarked on EA journey by formulating

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national EA framework known as the 1Government Enterprise Architecture (1GovEA). 1GovEA is a structured approach that defines Malaysian public sector role and services in business and technical aspect. The 1GovEA consists of EA framework, methodology and implementation plan aims to guide the Malaysian public sector agencies to develop EA for their respective agencies. Malaysian Administrative Modernisation and Management Planning Unit (MAMPU), is the central agency responsible to develop and implement the 1GovEA initiative. Prior to the introduction of 1GovEA, some agencies have paved their own ways in implementing EA in their agency. Most of them are driven by the agency transformational plan whilst some are originated within the IT department itself.

Although the discussion on EA development and implementation has started 25 years ago [12], most organisation are still facing the issues in ensuring a successful EA implementation. Despite of the comprehensive guideline from existing EA frameworks and methodologies, in reality the development and implementation of EA is not an easy task. Although there are many EA frameworks available, organisation still unable to translate the proposed EA solution to their own organisation needs [13]. This is because the existing EA frameworks focus on technology and business process solutions but do not address the challenges of EA development, implementation and adoption in the organisation [14, 15]

Previously, organisation tends to develop and implement EA in a large scale and this has increased the risk of failure [16]. As an alternative, it has been suggested to build the EA incrementally but the drawback of this approach is it takes time and discipline to ensure it progressing well [17]. As the consequences, EA initiatives took longer time to complete, which later it will get halted and even worst terminated.

Looking at the above weaknesses, this study suggested that it is important to identify and understand the challenges in the EA development and implementation scenario first before starting any EA initiatives. Hence, this will provide additional knowledge to the organisation prior embarking in EA journey. Therefore, the objective of this study is to identify the challenges faced by the Malaysian public sector agencies that are in development and implementation phase of EA.

The paper is organized as follows, next section discusses on the issues in EA development and implementation followed by a research framework for public sector EA development and implementation process. Next is the research methodology and findings are then presented in the next two sections, firstly explanation on the case studies findings and secondly on the challenges identified. Final section draws out the conclusion of the whole studies.

## 2. ISSUES IN ENTERPRISE ARCHITECTURE DEVELOPMENT AND IMPLEMENTATION

There are three main issues identified in EA development and implementation process. These issues has been arising due to the weaknesses in current EA frameworks and methodology which only focus on the EA technology and business aspect despite of the EA development process and implementation planning.

Before we go further on issues that hinder a successful EA development and implementation, it is essential to understand what are the basic phases involved. A typical establishment of the EA undergoes three phases: 1) the process of EA development and implementation, 2) the usage and operation of EA and; 3) the maintenance of EA [22]. According to Schekkerman [23] for EA to be valuable to the organisation, all three phases are equally important and need to be managed effectively.

Currently, the best practices in EA such as the Zachman Framework, the Federal Enterprise Framework (FEA) and The Open Group Architecture Framework (TOGAF) emphasize on operational efficiency and technology alignment, focusing on technology and process solutions that support business objectives [14]. They do not highlight the scenario and challenges of the organisation EA development, implementation and adoption. The elements of human resource, organizational change management and governance are also missing from the discussion. Studies shows that failure to address these elements can result the unsuccessful EA delivery because the organisation unable to adapt the EA solution proposed accordingly [15, 24].

Furthermore, public sector organisation are having difficulties with the EA development and implementation due to inflexibility and complexity in their nature of business and IT structures [13]. In US Federal EA programs, most agencies have produced unsatisfactory results and even some did not produce any results at all [18]. Same situation happened in Malaysia, as not many organisation

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willing to venture in EA initiative due to the lack of expertise and difficulties to associate the existing EA framework to their organization's needs [25-27].

Next issue is on the planning and scheduling approach of EA development and implementation. Study by Roeleven and Broer [28] reveal that more than 66 per cent of the EA program in the Netherlands did not fulfil the expectation due to longer time spend during the EA development and implementation process. Gartner Group predicted 40 per cent of all EA programs would be terminated by 2012 because of failure to demonstrate sufficient value to the business within the time frame stated [29]. EA development and implementation at a large scale is a risky process and it often fail due to the complexity, cost, size and business obstacle [16]. Another approach is to build the EA incrementally so EA is slowly developed without any significantly increased expenses [16, 17]. The only disadvantage of this approach is it requires more time and the stakeholder begin to lose focus to the initial EA planning.

The final issue is lack of studies on EA development and implementation. Despite of growing numbers of EA literatures in the past few years, the interest are more on EA frameworks and the technology aspect [21]. To date, only few studies discussed on EA development and implementation [18, 19] especially in the public sector area [2, 8, 20, 30]. In addition, many EA industry players and scholars are proposing EA frameworks and methodology, but yet it is too specific for the particular scenario defined. Hence, EA researcher and practitioner are unable to understand and propose the general best practice in EA development and implementation for future reference

## 3. PUBLIC SECTOR ENTERPRISE ARCHITECTURE DEVELOPMENT AND IMPLEMENTATION RESEARCH FRAMEWORK

The underpinning theory of this study is based on the Balanced Scorecard (BSC) by Kaplan and Norton and the common process in EA development and implementation from various EA methodologies.

BSC is a strategic planning and management system that is widely applicable to organizations in any size or type of business. It consists of a set of measures to assess how the organisation is progressing toward meeting its strategic goals. Originally BSC consists of four perspectives which are financial, customer, internal business process, and learning and growth perspective. For non-profit organizations (such as public sector), Kaplan and Norton [31] have introduced other measurement perspectives consist of internal process, learning and growth, authority support and cost which are adopted in this study. Figure 1 depicts the research framework of this study

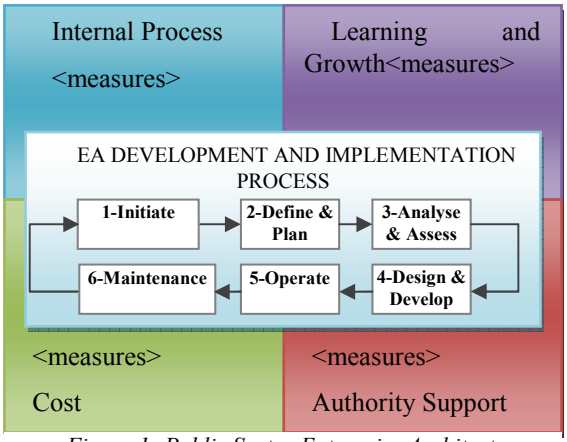


*Figure 1: Public Sector Enterprise Architecture Development And Implementation Research Framework*

In this study the internal business perspective is closely related to the customer perspective. This includes processes, decisions and actions occurring throughout the organisation. According to Kaplan and Norton it is recommended to focus on the internal processes that affect authorized entity satisfaction, such as quality, productivity and operation cycle time. The next perspective is the authority support. It refers to the role of the Chief Information Officer (CIO) and top management that have the utmost power to support the EA initiative. Some main areas of customer or authority support concern are time, quality, cost, and performance of the EA initiative itself.

For the learning and growth perspective, it means every organisation must make continual improvements in order to succeed in their environment. For example, the plan on how to increase quality of services provided and enhances the employee skills of the organisation through training and certification. The fourth perspective is the cost perspective, which involves profitability, cost and stakeholder value. The main concern here is the return on IT investment and EA contribution to the value-added services for the whole organisation. Based on the perspective explained, BSC is chosen because it provides a holistic perspective of the organisation towards its strategic intents [32] and EA goals [33].

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The measures are defined based on EA development and implementation challenges identified from this study and grouped to four BSC perspectives. Based on the argument by Bullen and Rockart [34], critical success factors (CSF) refer to things that must go right in order to successfully achieve objectives and goals. Therefore, it is believed that if the right challenges and issues are properly addressed and tackled, it will become the potential CSFs.

The EA development and implementation process were derived from the existing EA frameworks proposed by both academia and industry. Studies by Bakar, Harihodin, and Kama [35] recommended an EA Configurable Process Model (EACPM) which originated from Enterprise Architecture Planning (EAP), the Federal Enterprise Architecture (FEA), the Open Group Architecture Framework (TOGAF), Extended Enterprise Architecture (E2A), Enterprise Architecture Process Model (EAPM) and the State of Arizona's Enterprise Architecture. It is an iterative cycle whereby if there is any new or latest update on EA, all the processes will start again. The process starts from 1) initiate, 2) define and plan, 3) analyze and assess, 4) design and develop, 5) operate and 6) maintenance. The integrated analysis of challenges and processes in EA development and implementation will provided clearer picture on how these challenges are impacting the process. Therefore, appropriate solution can be provided based the EA development and implementation process identified, rather than wasting time and resources figuring the problematic part of whole EA initiatives

## 4. RESEARCH METHODOLOGY

This is an exploratory study with the intention to identify the challenges occurs during EA development and implementation process in the public sector agencies. As stated by Yin [36], case study research investigates a contemporary phenomenon in its natural setting. Therefore, this method is well suited in this study since the focus is on EA and how each of the agencies reacts to it.

The case studies consist of three public sector agencies with different background and functions. These sites were chosen based on the results of study in identifying the IT architecture maturity level in all Malaysian public sector agencies done by MAMPU in 2014. These three agencies score the highest level of maturity levels and have started the EA initiative for more than 1 year. Hence, they are the appropriate cases to study the EA development and implementation phenomenon in public sector settings.

The data were gathered by using multiple qualitative research methods consist of observation, interviews and document analysis. The reason for using method triangulation is to gain in depth information from the case studies and to ensure it rigorousness. It is also important to apply the triangulation to overcome the potential bias in any case study [36] and to ensure the validity and reliability of the study [37].

Interviews were conducted with EA team of the selected agencies. An interview protocol outlining the questions was used to guide the interviewer during the session. Each of the interviews lasted between thirty to ninety minutes and all were audio recorded and transcribed. General observations were also captured during the interview sessions and the EA workshop conducted by one of the agencies. The observations include the reaction and response of the interviewees and participants towards the researcher during the sessions. The researcher also monitored the cooperation and support given by the team in the EA program conducted.

All documents that are relevant to EA development and implementation were reviewed. These include all EA reports, IT strategic plan and the agency strategic plan. Subsequently, the interview transcripts, observation notes and document analysis were collected, organized, recorded and analyzed according to the BSC perspectives themes, as stated in research framework. Using Atlas.ti (CAQDAS, Computer Assisted Qualitative Data AnalysiS) all the collected data were then systematically identified and coded according to the predetermined themes. This thematic analysis process were systematically done based on steps defines by Braun and Clarke [38].

## 5. FINDINGS ON ENTERPRISE ARCHITECTURE DEVELOPMENT AND IMPLEMENTATION SCENARIO

This section highlights the scenario of EA development and implementation within the studied cases. Three cases are presented individually and every case is uniquely defined. The key challenges from each case are discussed thoroughly and summarized accordingly.

### 5.1 Case A Findings

Case A is based on one of the largest ministry in Malaysia. Its responsibility is to assist an

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individual in achieving and maintaining a certain level of health status to further facilitate in leading a productive lifestyle economically and socially. The EA initiative was setup based on recommendation from agency IT Strategic Plan (2006-2010). The objective is to provide holistic view of the businesses and to streamline information sharing among all 27 divisions under the seven programs in the ministry. IT Department was the main EA driver.

Ministry A started its first EA development in year 2006 until 2008. Development processes include the analysis of current business, information, application and technology environments, projection of the future environment, and recommendations for the target EA in terms of high-level models and principles. In 2009, the EA framework was launched and ready to be used. However, the development and implementation of the EA is not carried out as planned and the first EA initiative was halted for almost four years. Only when MAMPU started the 1GovEA initiative this ministry resume their EA development and analyzed the factors that hinder their initial plan.

Few issues have been identified such as lack of sufficient internal EA expertise, transfer of personnel trained in EA and change of organizational direction. By taking careful measures on prohibitive factors mentioned, the ministry has devised a new EA plan starting from year 2015 by tabulating their EA development planning and preparing their personnel with EA knowledge and skills. Follows by year 2016, the new EA solution will be developed and finally in 2017 it will be implemented and monitored by an EA Office.

In current EA approach, the initial development process is revisited and EA team decided to completely align it with a The Open Group Architecture Framework Architecture Development Method (TOGAF ADM). The redevelopment process is done internally by the EA certified personnel in the ministry. The team comprises of two departments in the ministry which are Telehealth and IT Division. To strengthen the team, the EA consultant from MAMPU and other EA experts are appointed as advisors to the team. To facilitate the new EA development and implementation plan, the ministry EA comprehensively refers to 1GovEA framework together with TOGAF tool, Archimate.

### 5.2 Case B Findings

Case B is the authorized agency that is in charge of Malaysia's financial and economic outcomes to ensure sustainable growth and prosperity for the people and the nation. The EA initiative was initiated from the Transformation Program (TP) and the first EA blueprint was developed from October 2013 until February 2014. The EA blueprint was developed based on the framework defined by an external consulting firm as a guide to build IT environment that supports the business needs.

The agency's main objective of EA is to facilitate collaboration on the standardization of data, application and infrastructure. The final aim is to ensure relevant data can be shared across multiple business functions through common applications and infrastructure. The EA initiative is led by IT Department with close monitoring by agency secretary general who also heads the agency transformation task force. Apart from that, the agency EA committee (TEAC) was established, headed by the CIO and supported by the EA office as the secretariat. As a first step in designing the EA, all 22 divisions in Case B are grouped under 8 functional clusters. Each cluster was asked to define detailed functions, data, processes and information requirements. Business Relationship Manager (BRM) is appointed to every functional cluster and is responsible to liaise with business owners on any new business requirements. The EA initial study shows there are 14 initiatives that will be rolled out from March 2014 to March 2016.

Among those, there are four major initiatives identified and agreed upon by the Case B top management. These are the initiatives that bring huge impact on the agency's strategic role in the country's financial and economic management. The initiatives are 1) to design and implement the database and analytics for fiscal and economic, 2) to move towards better procurement data, processing and analytics, 3) to implement consolidated government financial accounts (including balance sheet) and lastly 4) to upgrade communications and document sharing capabilities. To ensure the EA initiatives are executed as planned, a scorecard tracker is used for monitoring and tracking purpose.

### 5.3 Case C Findings

Case C is the principal public sector agency responsible for the preparation of development plans for the nation. This agency's philosophy is to encourage economic growth through distribution based on the needs of development and national solidarity through poverty eradication, restructuring of the society, rural economic development and

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corridor development. The main function of agency C is to manage the country's socioeconomic development in a strategic and sustainable manner.

There are four core functions of the agency which consists of planning, resource allocation, monitoring and stakeholder facilitation. For planning, the agency is responsible for socioeconomic research and analysis, policy development, macro-economic modelling and framework as well as plan development. Meanwhile, for resource allocation the task is mainly on budget management and project evaluation. Apart from that, the agency performs the monitoring process that covers the national program monitoring, initiative monitoring and project monitoring. Lastly, the agency also in charge of facilitating the stakeholders in the secretariat role in the Economic Council (EC) and National Development Planning Committee (JPPN).

The idea of EA comes into place in 2011 when the agency is developing the IT Strategic Plan (ISP) for the year 2011-2015. After a thorough study by the IT Department, finally the EA program was initiated in December 2012 and completed in July 2013. The initial plan was just to develop an Information Architecture (IA) which can cater the need of data warehouse for the agency. Eventually, after consultation with MAMPU IT consultants, the scope has been expended to include full EA development. During the development study, the agency has conducted a capability maturity assessment within the agency itself in order to identify their 'as-is' of IT Architecture scenario.

The agency applied the hybrid EA framework which is developed based on TOGAF and consultant's EA framework. In addition, they also incorporated security architecture elements to the framework. For the monitoring and governance purpose, the agency has established the EA Committee chaired by the agency deputy director general. The committee consists of representatives from IT and business users from every department. To promote the EA initiatives to all the personnel, various training and briefing session were done, including the executive talk series and workshops.

A quick win from this EA development and implementation is the alignment of IT functionality and information with the agency's four core functions. In addition, through EA the agency has identified 11 relevant initiatives covering infrastructure, governance, policies, and on system implementation. Now the agency is focusing on the immediate initiatives which are the development of EA repository tool and data warehousing tool in order to establish a centralized repository for internal and external data from other related agencies.

### 5.4 Summary of EA Development and Implementation Scenario in Malaysian Public Sector

In general, it can be concluded that every agency has own unique way and purpose in developing and implementing EA. The summary of EA development and implementation scenario for all cases is tabulated in Table 1. The key points highlighted are, every agency are using different kind of EA frameworks thus it reflect the choice of EA tools and repository later on. Study also shows only one agency is developing the EA with in-house approach while the other two appoint the external consultants. While for governance structure, all agencies have similar structure as they include both business and IT department in the EA initiative.

*Table 1: Summary of EA development and implementation scenario of three Malaysian public sector agencies*

| Key Points | CASE A | CASE B | CASE C |
|---|---|---|---|
| **EA Framework** | TOGAF | Consultant EA Framework | Hybrid (TOGAF & Consultant EA Framework ) |
| **Development Approach** | In-house development | Appoint Consultant | Appoint Consultant |
| **Governance Structure** | Equal collaboration between business and IT department | Governance structure in place and involve all management levels and departments | Governance structure in place and involve all management levels and departments |
| **EA Tools and Repository** | Possibility to use TOGAF and Archimate | No EA Tools defined | Possibility to use QPR Tools |

## 6. CHALLENGES IN ENTERPRISE ARCHITECTURE DEVELOPMENT AND IMPLEMENTATION

Prior to this exploratory case study, a comprehensive literature review and preliminary study were conducted to determine the challenges in EA development and implementation [39]. Most literatures highlighted that unclear communication, weak governance, unused of completed/partial completed document, lack of continuous support and insufficient financial resources are the main challenges. This is also supported by the

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preliminary interview conducted to the group of 1GovEA team of Malaysian public sector. Whereby only one literature stated political influence and economic pressure is a challenge and is it also not mentioned in the preliminary interview. The rest of the challenges identified are shown in Table 2.

*Table 2: List of EA development and implementation challenges from the literature review and preliminary study*

| | EA Development and Implementation Challenges | Sources |
|---|---|---|
| 1. | Unclear communication | 5 [13, 40-43]* |
| 2. | Weak governance | 5 [13, 40-43]* |
| 3. | Documentation completed but not in used or partially completed | 5 [13, 40-43] |
| 4. | Lack of continuous support | 5 [13, 18, 40, 42, 44]* |
| 5. | Insufficient financial resources allocated | 5 [40-43] |
| 6. | Insufficient supply of other resources | 4 [40-43]* |
| 7. | Complicated EA tools | 4 [45-48]* |
| 8. | Lack of EA assessment mechanism | 3 [2, 16, 49]* |
| 9. | Non-standardised business rules and process | 3 [13, 40, 43]* |
| 10. | Lack of EA acculturation | 3 [18, 40, 43]* |
| 11. | Lack of skilled architect | 3 [13, 40, 43]* |
| 12. | Limited EA training and certification available | 3 [13, 40, 43]* |
| 13. | EA is under recognition | 3 [41, 42, 50] |
| 14. | No mandated EA rules and processes | 3 [13, 40, 43]* |
| 15. | Adverse stakeholder participation | 3 [21, 45, 51]* |
| 16. | Usage of standard tools, methodology, framework and artefact | 3 [45, 52, 53]* |
| 17. | Lack of understanding of internal process | 3 [1, 40, 43] |
| 18. | Unique business driven approach | 3 [54-56]* |
| 19. | Limited planning, scope and coverage | 2 [4, 43]* |
| 20. | Undesirable political influence | 1 [45] |
| 21. | Economic pressure | 1 [43] |

*Challenges identified from preliminary study are marked **

The case study findings identified 20 matching challenges as suggested by the literature and preliminary study. Three challenges that are not relevant with the scope of Malaysian public sector will be dropped from the study. The irrelevant challenges are EA is under recognition, political influence and economic pressure. Findings from case study reported that those challenges did not occur during their EA development and implementation process. The final identified challenges are then organized according to four original BSC perspectives (internal process, learning and growth, authority support and cost) with addition of two new perspectives, technology and talent.

In general, findings from this study show that EA in the Malaysian public sector is still at infancy level and facing many challenges. Overall, all studied cases have their EA components implemented according to EA framework, but all are still in initial state. The following subsections explain each challenge according to six perspectives starting from internal process, learning and growth, authority support, cost, technology and talent management.

### 6.1 Challenges from Internal Process Perspective

In terms of internal process challenges, all cases agreed on the same challenges reported in the previous studies. The challenges are EA initiative is uniquely on business driven approach, unclear communication, weak governance, lack of understanding of internal process, limited planning, scope and coverage, and lastly no standardized business rules and process for EA. For Case A, the initial EA development and implementation was disrupted because initially the focus is on IT application and infrastructure, but not on the need of healthcare services, department's interoperability and functionality. Hence, EA was understood as another IT program, but not the enterprise-wide solution that uses the common IT platform that involved all departments. This is not happening for Case B because they have acknowledged the core function of the agency and put it as main reference in the EA blueprint. Meanwhile, for Case C, due to the unique business process, they faced the difficulty at the beginning of EA development and implementation because there is no agencies with similar functions can be used as a benchmark case. Nevertheless, Case C has to pave own way in implementing the EA.

Another issue is unclear communication faced by the agency. This is closely related with weak governance. The finding shows that, in Case A there is limited communication within the EA team member because the EA governance exists within the IT Division only. Therefore, it is suggested that, to overcome this issue the EA governance structure need to be established across the agency. Case A also has challenges in limited planning, scope and coverage of EA blueprint. This has caused a challenge for the agency to implement the initial blueprint in order to have a full completed EA solution in the future. Every case study has issues of understanding the internal process and non-standardized business rules process of the

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agency. This requires a whole organizational function re-assessment as this show there is lack of understanding on what is the core business function of the agency.

### 6.2 Challenges from Learning and Growth Perspective

Next challenges are on learning and growth perspective. There are five challenges identified in this perspective from existing literatures and the case studies selected. The challenges are, no EA assessment mechanism, completed or partially EA documentation exists but not in use, lack of EA acculturation in the agency, lack of skilled architects and limited EA training and certification available in Malaysia. The most highlighted issues by the literatures and the studied cases are on the scarcity of skilled enterprise architect. As the demand for EA is rising, the EA experts and skilled enterprise architects are still under supply.

In most agencies there is only one certified EA personnel or worse, none at all. The EA knowledge among the personnel is also limited to the basic level. Due to the lack of internal expertise in EA, EA development was outsourced to the consultant company. This is closely related to the limited EA training and certification available in Malaysia. To date, there is only one EA framework governing body that provides the complete training in Malaysia. As a result, for the hybrid and customized EA framework, EA team only experienced the on-the-job training facilitated by the consultants while doing the EA development.

Studies by MAMPU in 2014, shows that EA development and implementation in Malaysian public sector agencies is still at infancy level. This is due to the lack of EA acculturation programs. It is a challenge for the EA team to cultivate and explain what EA can bring to the organisation without a proper plan of EA acculturation programs. For Case A, the EA is treated as non-existent because no acculturation program is in place. Although the IT Architecture blueprint is available for download through the agency's website, users feel the blueprint is very technical and difficult to understand because they are not explained on that matter. Meanwhile, for Case C the EA team faced a challenge in creating a common architecture platform because the users were initially reluctant to share what they know and what they want to know. The users feel insecure to share their knowledge on agency core functionality and data because it might jeopardize their work. Therefore, it is vital for the team to organize the acculturation program at early phase of EA development and implementation in order to overcome this kind of challenge.

All cases agreed that there is nonexistence of the systematic EA assessment mechanism therefore the EA team are not sure if they doing it right or wrong. The EA activities were executed based on the initial plan in the EA blueprint without any checking mechanism in practice. Most of the time, EA activities are based on 'trial and error' approach. Same issues also occur on the EA documentation. As stated in literature and all studied cases, EA documentation is completed or partially completed but not used. For Case A, it is found out that complete EA documentation exists but it does not provide guidelines on how to implement it. Whereas Case B and C, the whole EA documentation is partially completed because Case B chooses to do it by phases (according to IT application's priority) while Case C documentation approach is based on EA layers starting from business, data, application and lastly technology.

### 6.3 Challenges from Authority Support Perspective

Based from the previous literatures, there are five main challenges related to authority entity perspectives. The challenges are lack of continuous support, EA is under recognition, no mandated EA rules and processes, political influence and stakeholder participation. All challenges are relevant to the studied cases except for the point, EA is under recognition and political influence.

Most of the top managements are now aware of the ability of EA and the returns that can be earned from it. This is a very positive development, however new challenge arises which is unrealistic expectations. Since the agencies undertaken the EA initiatives, the management always looked forward for report on improvements in IT service quality such as faster IT systems, unlimited data access as well as on the savings of IT expenditure. They also expect the process of EA development and implementation can be carried out in such a short time like any other IT application development, regardless of the constraints in getting the skilled EA personnel and the complexity in aligning the IT and business process.

As reported by Case B, the initial development period of the EA Blueprint is cut short from three years to two years as per director request. Therefore the EA Team has to comply with this request because it has involved the organization's stakeholder participation. Meanwhile, for Case A and C, the stakeholders expect fast results and

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integrated IT applications throughout the departments after EA come into the picture. Another challenge faced by the agencies is no mandated EA rules and processes implies. In most agencies, although EA rules and process are available, there is no official circular instructing the agency to implement it. The agency also has no power to influence and request other agencies to comply for their request of an architecture data and IT applications. As a result, there is no follow up action after the completion of the EA blueprint and framework in some of the agencies.

### 6.4 Challenges from Cost Perspective

The forth BSC perspective is cost. The literatures suggested there are three issues in EA cost which are the insufficient financial and other resources, together with the pressure from the economy and cost. However, Malaysian public sector agencies there is no issue in economic pressure because the EA initiative is embedded in the agency's budget plan. Specific fund for EA is allocated in the agency budget at the beginning of financial year. The only challenge in this perspective is on the financial and other resource allocation. Since financial resources are strictly based on the agencies budget and allocation, problem may arise if there is a sudden need of financial support. This may be due to the unforeseen problem in EA activities or when there is an unavoidable change to the initial EA plan that requires some amount of money. Another concern is on people resources. All studied cases reported that there are insufficient dedicated personnel for EA program. It is impossible to have a full-time EA project team since the project team members are also associated with other projects. Therefore, it is suggested for the agency to have a specific EA office to ensure all EA activities will be executed as planned with a sufficient workforce.

### 6.5 Challenges from Technology Perspective

This study suggests two other new perspectives, which are technology and talent management perspectives. In EA, technology plays the important roles because there is where the bottom layers of EA sits. The biggest concern in Malaysian public sector EA scenario is, no standardized EA approach (methodology, framework and tools) across the agencies. This will affect the interoperability process between the agencies and as a result EA will not be optimized as expected.

All cases admitted that they have not figured out the ways on how to fit in their existing EA framework to the 1GovEA. This also means that these pioneering agencies need to study both frameworks in order to find out the integration solution. This is not an easy task because the EA team stated that the existing EA blueprint is very technical and does not provide the guidelines on how to implement the EA components. To complicate the situation, some of the framework is a hybrid EA framework and customized for that agency only, therefore they are unable to communicate and share their EA issue with another agency. Same situation also happens to the usage of EA tools, as it is not standardized and being under-utilized by some of the agencies.

### 6.6 Challenges from Talent Management Perspective

Finally, the unique challenge faces in the Malaysian public sector are on talent management. All agencies are having difficulties in retaining the expertise because there is always a probability that the team members will be transferred to another agency when they are promoted. This relocation is unavoidable due to the nature of IT personnel profession in the Malaysian public sector. Therefore, the agency needs to retrain the new team members and it is a waste of skill for the EA skilled personnel if their new agencies do not have an EA in practice.

To date, there is also no centralized public sector EA expert team exists. The agencies believed that MAMPU need to address this gap. All EA teams from the case studies agreed that it is difficult to get the EA support and consultation from the EA experts who have the knowledge of Malaysian public sector business process. The summary of challenges identified is presented in a case-ordered matrix [57] as shown in Table 3.

*Table 3: Case-ordered matrix table on the EA challenges in Malaysian public sector agencies*

| THEMES ☑-Exist ☐-Non Existence | CODES From previous studies [39] | Other Literatures | Case A | Case B | Case C |
|---|---|---|---|---|---|
| Internal Process Perspective | 1. Unique business driven approach | ☑ | ☑ | ☐ | ☑ |
| | 2. Unclear communication | ☑ | ☑ | ☐ | ☐ |
| | 3. Weak governance | ☑ | ☑ | ☐ | ☐ |
| | 4. Lack of understanding of internal process | ☑ | ☑ | ☑ | ☑ |
| | 5. Limited planning, scope and coverage | ☑ | ☑ | ☐ | ☐ |

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| THEMES ☑-Exist ☐-Non Existence | | CODES From previous studies [39] | Other Literatures | Case A | Case B | Case C |
|---|---|---|---|---|---|---|
| | 6. | Non-standardized business rules and process | ☑ | ☑ | ☑ | ☑ |
| Learning and Growth Perspective | 7. | No assessment mechanism | ☑ | ☑ | ☑ | ☑ |
| | 8. | Documentation completed but not in used or partially completed | ☑ | ☑ | ☑ | ☑ |
| | 9. | Lack of EA acculturation | ☑ | ☑ | ☐ | ☑ |
| | 10. | Lack of skilled architect | ☑ | ☑ | ☑ | ☑ |
| | 11. | Limited EA training and certification available | ☑ | ☐ | ☑ | ☑ |
| Authority Support Perspective | 12. | Lack of continuous support | ☑ | ☑ | ☐ | ☐ |
| | 13. | EA is under recognition | ☑ | ☐ | ☐ | ☐ |
| | 14. | No mandated EA rules and processes | ☑ | ☑ | ☐ | ☐ |
| | 15. | Undesirable political influence | ☑ | ☐ | ☐ | ☐ |
| | 16. | Adverse stakeholder participation | ☑ | ☑ | ☐ | ☑ |
| Cost Perspective | 17. | Insufficient financial resources allocated | ☑ | ☑ | ☑ | ☑ |
| | 18. | Economic pressure | ☑ | ☐ | ☐ | ☐ |
| | 19. | Insufficient supply of other resources | ☑ | ☑ | ☑ | ☑ |
| Technology Perspective | 20. | Complicated EA tools | ☑ | ☑ | ☑ | ☑ |
| | 21. | Usage of standard tools, methodology, framework and artefact | ☑ | ☑ | ☑ | ☑ |
| *Talent management (New Theme)* | 22. | Retention of expertise* | ☐ | ☑ | ☑ | ☑ |
| | 23. | Centralized EA experts team* | ☐ | ☑ | ☑ | ☑ |

## 7. CONCLUSION

The in-depth case studies reveal the invaluable experience and scenario of each Malaysian public sector agencies in developing and implementing EA. This study has identified 20 challenges faced by the Malaysian public sector agencies. Since most of EA studies are conducted in other countries and different setting such as private sector industry, there are points reported in the literatures that are irrelevant to the case studied. Therefore, data from field works allows the researchers to find the conformity and the contrasting points on the EA development and implementation challenges.

The study contributes to the understanding of the challenges that have possibly influenced the successful EA development and implementation in an organisation. Most importantly, this study indicates that advanced technology, complete EA framework and documentation do not guarantee that an EA initiative will be successfully implemented and fully utilized. Instead, this paper highlighted that it is important to identify the challenges arise and necessary action should be in place to resolve it. In general, the critical challenges faced by most public sector agencies are the similar and related to each other which are 1) no EA assessment mechanism, 2) complicated and no standardized EA approach (methodology, framework and tools) across the Malaysian public sector, 3) lack of EA experts and skillful personnel in EA and; 4) insufficient resources allocated to EA initiative.

However, the data set of this study is rather limited to the phenomenon of the specific cases. Therefore, to enhance this study for generalizability, the next stage is to confirm the identified challenges and key issues in EA development and implementation with the EA experts and across the studied public sector agencies. In the future, the researcher plan to explore ways to develop an EA development and implementation assessment mechanism with the aim to assist the EA team in ensuring the EA project successfully delivered.

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